Combustibility of RTV Silicone Foam Penetration Seals

"After it was determined that silicone foam fire testing data had been lost in a fire, Brand Industrial Services, Inc. (BISCO) a fire barrier vendor, re-tested their nine-inch silicone foam penetration seal design. The design reportedly failed the three hour fire endurance test. It is my understanding that this particular seal design has never passed the three hour fire endurance test in the U.S. Tests on similar designs conducted in Europe have reportedly failed in less than 90 minutes, which is less than half the minimum fire endurance requirement in the U.S. as tested to the same time/temperature curve used in the U.S. Notwithstanding these problems, this particular design is reportedly installed in 56 nuclear power stations in the U.S."

QUESTION 8a. Can NRC provide justification for the extensive sales and application of RTV silicone foam throughout the nuclear power industry as fire barrier penetration seals without apparent agency oversight or a verification process to determine that licensees were qualifying the Dow Corning material as non-combustible per requirement of 10 CFR 50 Appendix R Section III Subpart M?

ANSWER.

The application of silicone-based materials as fire penetration seals by the nuclear power industry has not taken place without agency oversight or verification of the fire resistive performance of silicone-based materials by the staff. The staff has been aware of the combustible properties of silicone foam from the time of its earliest applications in nuclear power plants. A Safety Evaluation Report (SER) written by the staff for Browns Ferry Units 1 and 2, dated March, 1976, following the March 22, 1975 fire, approved the licensee's proposed use of silicone foam as a penetration seal-fire stop.

The staff has also reviewed the requirements of Appendix R to 10 CFR Part 50 and the guidance of the Section 9.5.1 of the Standard Review Plan (SRP). The staff reviewed the record for Appendix R (including interviews with the principal author of Appendix R) and found no technical basis for including the noncombustibility criterion in Appendix R. The noncombustibility criterion is included in the SRP because the SRP simply embodied the criterion of Appendix R. The staff noted that the noncombustibility criterion is not included in BTP APCSB 9.5-1, Appendix A to BTP APCSB 9.5-1, or the industry fire endurance test standards. The ability of a particular penetration seal to achieve its intended design function (i.e., to contain a fire), as determined by a fire endurance test conducted in accordance with an industry standard, is the foremost design consideration. In addition, because of the severity and duration of the fire exposure, the industry standards would ensure that fire-resistant seal materials are used and would preclude the qualification of materials that present fire hazards. It is clear from the staff's review that NRC fire protection regulations were never intended to preclude the use of silicone-based materials in fire barrier penetration seals.

Silicone foam and silicone elastomer can be combined with other materials to form radiological shields; fill complex irregular openings (e.g., around cables in cable trays) and adhere to the penetration and the penetrants; cure rapidly; and can be removed and restored to their original effectiveness (e.g., when making such plant modifications as installing new cables); have high-

temperature stability; are flexible; and resist the effects of radiation exposure and aging. Silicone elastomers can also be used as flood and pressure seals. A wide variety of silicone-based penetration seal designs have been tested and listed by material manufacturers and installers; by UL, in its *Fire Resistance Directory*; and by FM, in its *Factory Mutual System Approval Guide*. It is also notable that other countries, government agencies, insurance bodies, and building codes accept the use of silicone-based penetration seals. For these reasons, silicone foam and silicone elastomers are accepted for use in penetration seals in a wide variety of residential, commercial, and industrial buildings where fire-resistive separation is needed.

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QUESTION 8b. On what basis does the NRC allow the untested nine inch silicone foam penetration seal design to exist in nuclear power stations?

ANSWER.

It is the staff's understanding that the 9-inch-thick silicone foam seal has been tested. The issue with this seal design is whether or not it can achieve a full 3-hour fire resistance rating (see following paragraph). In Generic Letter 86-10, "Implementation of Fire Protection Requirements," dated April 24, 1986, the NRC established that certain penetration seals need not have the same fire rating as the barrier in which they are installed. Licensees evaluate such seals on a case-by-case basis. The engineering evaluations performed to assess the effectiveness of the penetration seals are based on the expected fire-resistive performance of the seal and on the fire hazards and fire protection features in the area. When properly evaluated, a 9-inch-thick silicone foam seal may be acceptable for a given application.

On the basis of an NRC inspection, it is the staff's understanding that American Nuclear Insurers (ANI) and BISCO had taken actions to inform the plants with the undammed 9-inch-thick silicone foam seals about the problems and to suggest methods for upgrading the seals to achieve a 3-hour fire resistance rating. After its inspection, the staff issued Information Notice 88-04, "Inadequate Qualification and Documentation of Fire Barrier Penetration Seals," to alert the industry to possible problems with the qualification of fire barrier penetration seals and to emphasize the importance of ensuring that the installed seal is representative of the tested configuration. The action the staff took to alert licensees of potential problems (IN 88-04), including those involving qualification tests, was commensurate with the low safety significance of the potential problems. A generic action that required plant-specific responses was not warranted.

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 8c. Can NRC provide justification for the agency's further assistance to BISCO's marketing effort to South Korea?

ANSWER.

In its letter of April 18, 1990, BISCO requested NRC staff clarification of NRC Information Notice 88-56, "Potential Problems with Silicone Foam Fire Barrier Penetration Seals," and asked if the NRC accepted or rejected silicone foam for the construction of penetration seals. In its response of May 16, 1990, the NRC staff stated its position that silicone foam appeared to be an acceptable material for fire barrier penetration seals provided it is properly installed. The NRC staff also summarized potential problems with penetration seals. The NRC staff addressed BISCO's questions with factual information, it did not do so to aid BISCO's marketing efforts.

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 8d. Why hasn't the NRC followed up and determined if the licensees who are using the nine inch silicone foam system have properly repaired the defective design?

ANSWER.

The NRC staff has previously reviewed this issue and conducted inspections of BISCO. In 1985, American Nuclear Insurers (ANI) withdrew their approval of the BISCO 9" undammed Silicone Foam Seal due to concerns with the ability of the seal to successfully pass a 3-hour fire endurance test in accordance with ASTM E-119. An inspection was conducted at Brand Industrial Services Company (BISCO) by the NRC, in which a Notice of Violation was issued to BISCO for failing to inform all plant sites where BISCO installed 9" Silicone foam seals of questions about the qualification of the 9" silicone foam seal. All of the utilities affected were notified by ANI, and eventually contacted by BISCO with information regarding the upgrading of the 9" silicone foam seal to ensure a 3-hour fire rating. The inspection report for this inspection was dated May 22, 1987. The findings of this report led to the staff issuing Information Notice 88-04, "Inadequate Qualification and Documentation of Fire Barrier Penetration Seals," which alerted the industry to possible problems with the qualification of fire barrier penetration seals.

The staff most recently inspected Brand Fire Protection Services, Incorporated (Brand), in November 1995. The inspection found Brand's quality assurance program to be adequate, and did not reveal any discrepancies in qualification fire tests and typical details that Brand had used for installations of fire barrier penetration seals in various plants.

Information Notice 97-70, "Potential Problems with Fire Barrier Penetration Seals," reminds industry that they are required by 10 CFR 50.65 to take industry-wide operating experience (including information presented in NRC information notices) into consideration, where practical, when setting goals and performing periodic evaluations. In addition, the NRC's routine fire protection inspection procedures which are contained in NRC Inspection Manual Inspection Procedure 64704, "Fire Protection Program," were revised in September 1997, to provide more specific guidance for inspecting fire barrier penetration seals and establishing their functionality. The information notices and the enhancement of the inspection program are commensurate with the safety significance of problems with fire barrier penetration seals.

inspection results?

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 8e. Why was there no enforcement action taken against the vendor and the utilities who knew of the problem as stated yet never corrected it?

ANSWER.

In 1985, American Nuclear Insurers (ANI) withdrew its approval of a BISCO undammed 9-inch-thick silicone foam seal in response to concerns about the ability of the seal to pass a 3-hour fire endurance test. In 1987, the NRC conducted an inspection at BISCO to review this issue. As a result of the inspection, a Notice of Violation was issued to BISCO for its failure to adopt and establish a procedure for informing applicable plant sites that there were questions about the qualifications of the 9-inch seal. Nevertheless, during the inspection, the staff found that ANI and BISCO had taken actions to inform the plants with the undammed 9-inch-thick silicone foam seals about the problems and to suggest methods for upgrading the seals to achieve a 3-hour fire resistance rating. The staff determined that the plants with the BISCO undammed 9-inch-thick silicone foam seals had contemporaneously been informed about the potential problems and about fixes for the seals. After its inspection, the staff issued Information Notice 88-04, "Inadequate Qualification and Documentation of Fire Barrier Penetration Seals," to alert the industry to possible problems with the qualification of fire barrier penetration seals and to emphasize the importance of ensuring that the installed seal is representative of the tested configuration. The action the staff took to alert licensees to potential problems (IN 88-04), including those involving qualification tests, was commensurate with the safety significance of the potential problems.

Later, as part of the technical assessment documented in NUREG-1552, the staff inspected Brand Fire Protection Services, Incorporated (previously BISCO), again (November 1995). The staff reviewed Brand's quality assurance program and a number of qualification fire tests and design details used by Brand to install penetration seals in various plants. The staff found no discrepancies. On these bases, the staff closed the issue of the BISCO undammed 9-inch-thick silicone foam seals.

The staff recently completed a search for NRC inspections of penetration seal programs. The staff found that between 1991 and 1997, it had conducted 105 inspections that involved installed penetration seals and penetration seal programs at 77 plants. The scope of the inspections varied from plant to plant and ranged from narrow to broad. The inspectors reviewed the adequacy of penetration seal installations, qualification, and surveillances. They also followed up on issues reported in licensee event reports (LERs) and weaknesses noted during previous NRC inspections. In some cases, the inspectors reviewed the 100 percent penetration seal reevaluation programs performed by the licensees. In other cases, the inspectors walked down the seal installations to assess their adequacy. In general, the inspectors found that the penetration seal programs were comprehensive, timely, and acceptable. The staff has found no evidence of licensees who knew of problems with fire barrier penetration seals and did not correct them in a timely manner.

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 8f. Why has the NRC staff neglected the draft Information Notice 88-XXX (sic) design details and opted to ignore detailed staff guidance for fire penetration seals?

ANSWER.

Design parameters and attributes that should be considered are not explicitly stated in existing NRC fire protection regulations or review guidance. It is the staff's opinion that, in general, the fire test standards themselves and good engineering practice were adequate to identify the penetration seal design parameters that should have been considered in such engineering evaluations. Nevertheless, the lack of specific NRC review guidance for comparing tested configurations to as-built configurations can lead to technical questions regarding the adequacy of a particular seal design. This is a potential, albeit minor, weakness in the NRC fire protection program.

As part of the assessment documented in NUREG-1552, the staff revisited a draft version of Information Notice 88-04 that it had prepared in 1987. The draft, which is sometimes referred to as Information Notice 87-XX, contained general considerations about the use of fire test results to qualify fire barrier penetration seal designs. Even though these considerations were not included in the final version of the information notice, the draft information notice appears to be widely available to industry. In addition, industry fire protection engineers informed the staff that some licensees follow the considerations stated in the draft information notice even though the staff did not issue them. This indicates that such guidance would be useful to the industry for future penetration seal design evaluations.

On the aforementioned bases, the staff plans to include additional guidance in any future fire protection guidance document (e.g., a regulatory guide) to clarify the important parameters for designing and qualifying fire barrier penetration seals. Examples of the design considerations that could be included as guidance are presented in NUREG-1552. These considerations are not existing staff positions, but are proposed as starting points for preparing guidelines that could be used for designing fire test programs, for assessing fire test results, and for performing engineering evaluations of penetration seal designs installed in the future.

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 8g. When is the NRC planning to enforce its finding of BISCO's sealing system lacking proper fire tests and ensure that the utilities relying on this untested design have remedied the problem.

ANSWER.

The staff has no plans for further action concerning the BISCO 9 inch foam seal.

In 1985, American Nuclear Insurers (ANI) withdrew their approval of the BISCO 9" undammed silicone foam seal due to concerns with the ability of the seal to successfully pass a 3-hour fire endurance test in accordance with ASTM E-119. An inspection was conducted at Brand Industrial Services Company (BISCO) by the NRC, in which a Notice of Violation was issued to BISCO for failing to inform all plant sites where BISCO installed 9" Silicone foam seals of questions about the qualification of the 9" silicone foam seal. All of the utilities effected were notified by ANI, and eventually contacted by BISCO with information regarding the upgrading of the 9" silicone foam seal to ensure a 3-hour fire rating. The inspection report for this inspection was dated May 22, 1987. The findings of this report led to the staff issuing Information Notice 88-04, "Inadequate Qualification and Documentation of Fire Barrier Penetration Seals," which alerted the industry to possible problems with the qualification of fire barrier penetration seals. In view of the low safety significance of this issue, it is the staff's position this was an appropriate regulatory response to the issue.

The staff most recently inspected Brand Fire Protection Services, Incorporated (Brand), previously BISCO, in November 1995. The inspection found Brand's quality assurance program to be adequate, and did not reveal any discrepancies in qualification fire tests and typical details that Brand had used for installations of fire barrier penetration seals in various plants. The inspection report is dated February 6, 1996.

Information Notice 97-70, "Potential Problems with Fire Barrier Penetration Seals," reminds industry that they are required by 10 CFR 50.65 to take industry-wide operating experience (including information presented in NRC information notices) into consideration, where practical, when setting goals and performing periodic evaluations. In addition, the NRC's routine fire protection inspection procedures which are contained in NRC Inspection Manual Inspection Procedure 64704, "Fire Protection Program," were revised in September 1997, to provide more specific guidance for inspecting fire barrier penetration seals and establishing their functionality. The information notices and the enhancement of the inspection program are commensurate with the safety significance of problems with fire barrier penetration seals.

Combustibility of RTV Silicone Foam Penetration Seals

The Nuclear Information and Resources Service (NIRS) raised concerns regarding RTV silicone foam as one issue in the technical review and safety evaluation of the Watts Bar startup program in a letter dated October 26, 1995. In response to these concerns, a letter from Mr. Conrad McCracken, Chief, Plant Systems, Branch, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation, dated December 12, 1995 acknowledged that silicone foam seal materials are combustible and that "the use of silicone foam and silicone elastomer is an acceptable deviation from the penetration seal guidance of NUREG-0800." However, the NRC response does not provide a single reference to 10 CFR 50 Appendix R Section III Subsection M, which states that fire barrier penetration seal designs shall utilize only non-combustible materials.

QUESTION 9a. What criteria did NRC use to qualify the use of combustible RTV silicone foam as an "acceptable deviation" from 10 CFR 50 Appendix R Section III Subpart M?

ANSWER.

The NRC response did not refer to Section III.M of Appendix R because this section of the regulation is not applicable to Watts Bar.

On November 19, 1980, the NRC published Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, and a revised Section 10 CFR 50.48, "Fire protection," in the Federal Register. The revised Section 50.48 and Appendix R became effective February 17, 1981. It is important to note that Appendix R is not a set of generic fire protection requirements applicable in its entirety to every nuclear power plant and that it applies only to certain plants that were operating prior to January 1, 1979.

Section III of Appendix R contains 15 subsections, lettered A through O, which specify requirements for nuclear power plant fire protection features. These requirements are divided into two categories. The first consists of those requirements that were backfit to facilities operating prior to January 1, 1979, regardless of whether or not the staff had previously approved alternatives to the requirements of those sections. These requirements are set forth in Section III.G, "Fire protection of safe shutdown capability," Section III.J, "Emergency lighting," and Section III.O, "Oil collection systems for reactor coolant pumps." The second category consists of requirements that were backfit on a plant-specific basis to the extent needed to resolve the "open" items of previous NRC staff fire protection reviews. An open item was defined as a fire protection feature that had not been previously approved by the NRC staff as satisfying the guidelines of Appendix A to Branch Technical Position (BTP) APCSB 9.5-1, as documented in a staff safety evaluation report. Section III.M, "Fire barrier cable penetration seal qualification," of Appendix R was one such provision. Section III.M of Appendix R applies to: Duane Arnold, Robinson 2, Maine Yankee, Monticello, Vermont Yankee, and Peach Bottom 2/3.

Combustibility of RTV Silicone Foam Penetration Seals

QUESTION 9b. How does NRC define "acceptable deviation" with regard to fire protection safety?

ANSWER.

The NRC adheres to the application of a defense-in-depth concept of echelons of safety systems to achieve the high degree of safety required for nuclear power plants. This concept is also applicable to nuclear power plant fire safety. The defense-in-depth approach applied to the fire protection program is designed to achieve an adequate balance in: (1) preventing fires from starting; (2) detecting quickly, controlling, and extinguishing promptly those fires that occur; and (3) protecting structures, systems, and components so that a fire that is not promptly extinguished will not prevent the safe shutdown of the plant. NRC fire protection requirements and guidance implement this defense-in-depth approach and specify a level of fire protection which considers the potential consequences that a fire may have on the safe shutdown of the reactor.

The NRC fire protection regulation is Title 10 of the *U.S. Code of Federal Regulations,* Part 50, Section 50.48, "Fire protection," (10 CFR 50.48). Section 50.48 states that each operating reactor must have a fire protection program that satisfies General Design Criterion (GDC) 3, "Fire protection," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50. The objective of the fire protection program is to minimize both the probability and consequences of fires. Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50, establishes, for such facilities, fire protection features required to satisfy GDC 3. The Appendix R requirements of interest here are specified in Section III.G, "Fire protection of safe shutdown capability."

Guidance for implementing NRC fire protection requirements is contained in (1) Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1976, (2) Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," August 23, 1976, and (3) Standard Review Plan (NUREG 0800), Section 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," July 1981. These documents provide information, staff recommendations, and guidance which may be used by the licensees to meet the requirements of 10 CFR 50.48, Appendix R, and GDC 3. These documents also refer the licensees to such national consensus standards as American Society for Testing and Materials (ASTM) and National Fire Protection Association (NFPA) standards, for detailed guidance on implementing typical industrial fire protection features such as fire detectors, sprinkler systems, and fire barriers.

To deviate from one or more of the provisions specified in the regulation or a guidance document, the licensee must demonstrate, by means of a detailed fire hazards analysis, that existing protection or existing protection in conjunction with proposed modifications will provide a level of safety equivalent to the technical requirements of the regulation or the guidance document. Generally, the staff will accept an alternate fire protection configuration on the basis of a fire hazards analysis if:

(1) the alternative ensures that one train of equipment necessary to achieve hot shutdown from either the control room or emergency control stations is free of fire damage; and

(2) the alternative ensures that fire damage to equipment necessary to achieve cold shutdown is limited so that it can be repaired within a reasonable time (minor repair using components stored on the site); and

(3) modifications required to meet the technical requirements of the regulation or the guidance document would not enhance fire protection safety levels above that provided by either existing or proposed alternatives.

The staff will also accept an alternative fire protection configuration on the basis of a detailed fire hazards analysis when the licensee can demonstrate that modifications required to meet the technical requirements of the regulation or the guidance document would be detrimental to overall facility safety, the alternative configuration satisfies the three aforementioned criteria, and the alternative configuration provides an adequate level of fire safety.

Penetration Seal Installation Problems

"NRC documentation in NUREG-1552 identifies that a typical nuclear power unit can have as many as 10,000 penetration seals installed throughout the nuclear power station. NRC documentation in SECY-96-146 describes a review of reactor operating experience with RTV silicone foam that found that licensees for about 20 reactors had submitted a total of 141 Licensee Event Reports (LERs) related to problems with fire barrier penetration seals between 1989 and 1993. The review identified that 58% of the LERs regarded 'Seal inoperable or deficient due to improper installation, degradation or seal breach.'"

"An additional 26% of the LERs involved instances in which a 'Seal [was] not installed or missing.' Consequently, a total of 84% of the associated problems with fire barrier penetration seals were related to installation problems. The NRC has also issued several Information Notices (INs) regarding silicone foam problems. IN 88-56, entitled 'Potential Problems with Silicone Foam Fire Barrier Penetration Seals' dated August 4, 1988, documents the potential installation problems involving voids, gaps and splits in fire barrier penetration seals could result in the reduction of the fire resistive capabilities for protection of safety-related redundant equipment and electrical power and control circuits.

QUESTION 1. What, in the NRC's view, do these findings mean for the presumed aging stability of RTV silicone foam?

ANSWER.

It is the staff's view that the subject problems are not age-related. Sandia National Laboratories (SNL) has reported that many fire barrier materials are resistant to thermally accelerated aging and that the material properties of silicone-based materials are particularly age independent. SNL concluded that these materials are not expected to exhibit problems as they age. Moreover, on the basis of its review of operating experience and the technical literature, SNL did not find any penetration seal problems that were directly related to aging. The NRC staff has not found any evidence that the aging of RTV silicone foam seals is affected by potential installation problems, including voids, gaps, and splits.

Penetration Seal Installation Problems

QUESTION 2a. What assurances can NRC provide that inadequate fire barrier penetration seal configurations involving exposed or unprotected RTV foam seals have been identified by licensee inspections?

ANSWER.

Fire barrier penetration seal inspections performed by both the licensees and the NRC staff provide reasonable assurance that potential problems are found and corrected. Visual inspections can easily determine whether or not a required damming board is in place. It should be noted, however, that not all seals require permanent damming material.

The NRC staff inspects licensee fire barrier penetration seal programs during fire protection program and fire protection functional inspections to ensure that the licensees properly test, install, and monitor penetration seals. The staff recently completed a search for NRC inspections of penetration seal programs. The staff found that between 1991 and 1997, it had conducted 105 inspections that involved installed penetration seals and penetration seal programs at 77 plants. The scope of the inspections varied from plant to plant and ranged from narrow to broad. The inspectors reviewed the adequacy of penetration seal installations, qualification, and surveillances. They also followed up on issues reported in licensee event reports (LERs) and weaknesses noted during previous NRC inspections. In some cases, the inspectors reviewed the 100 percent penetration seal reevaluation programs performed by the licensees. In other cases, the inspectors walked down the seal installations to assess their adequacy. In general, the inspectors found that the penetration seal programs were comprehensive, timely, and acceptable.

The licensees have fire barrier penetration seal surveillance and maintenance programs that are governed by written procedures. In general, the licensees inspect a portion of the total population of seals every refueling outage (about every 18 months). If penetrations seals are found to be degraded or inoperable (e.g., breached, degraded, or improperly repaired) the licensees document the deficiencies and take appropriate corrective actions. If such conditions are found during power operations, the licensees establish such NRC-approved compensatory measures as fire watches until the degraded condition is corrected.

Finally, as documented in NUREG-1552, the staff has found that the generic actions it has taken to address potential penetration seal problems (Information Notice [IN] 88-04, Supplement 1 to IN 88-04, IN 88-56 and IN 94-28) increased industry awareness of penetration seal problems and resulted in more thorough surveillances, maintenance, and corrective actions.

Penetration Seal Installation Problems

QUESTION 2b. Is the NRC capable of estimating what percentage of fire barrier penetration seals are inaccessible to inspections? If so, please provide the estimation of this percentage as well as the rationale used by NRC to reach it.

ANSWER.

No, however, NRC fire protection engineers and inspectors believe that most fire barrier penetration seals are accessible for inspection. In some cases, special circumstances (e.g., erection of scaffolding) or precautions (radiation protection measures for personnel) would be involved. This determination is based on years of experience during NRC inspections at a large number of nuclear power plants.

Penetration Seal Installation Problems

QUESTION 2c. Given the difficulties involved in inspecting installed seals, what will the NRC do to ensure that firestops have been properly tested, monitored and inspected?

ANSWER.

The NRC staff inspects licensee fire barrier penetration seal programs during fire protection program and fire protection functional inspections to ensure that the licensees properly test, install, and monitor penetration seals. The staff recently completed a best effort search for NRC inspections of penetration seal programs. The staff found that between 1991 and 1997, it had conducted 105 inspections that involved installed penetration seals and penetration seal programs at 77 plants. The scope of the inspections varied from plant to plant and ranged from narrow to broad. The inspectors reviewed the adequacy of penetration seal installations, qualification, and surveillances. They also followed up on issues reported in licensee event reports (LERs) and weaknesses noted during previous NRC inspections. In some cases, the inspectors reviewed the 100 percent penetration seal reevaluation programs performed by the licensees. In other cases, the inspectors walked down the seal installations to assess their adequacy. In general, the inspectors found that the penetration seal programs were comprehensive, timely, and acceptable. In some cases, the inspectors found deficiencies and issued notices of violations. The staff will include a detailed summary of the inspections in its planned update of NUREG-1552.

The NRC's routine fire protection inspection procedures are contained in NRC Inspection Manual Inspection Procedure 64704, "Fire Protection Program." During September 1997, the staff revised these procedures to provide more specific guidance for inspecting the seals and establishing their functionality.

Penetration Seal Installation Problems

QUESTION 2d. In light of the numerous reported problems with both the installation and combustibility of RTV silicone foam, why hasn't the NRC issued a Generic Letter identifying the generic problems and requiring action on behalf of all the affected licensees?

ANSWER.

On the basis of the recent reassessment of fire barrier penetration seal problems, as documented in NUREG-1552, the staff concluded that the actions it had taken in 1988 to alert licensees to potential penetration seal problems increased industry awareness of such problems and resulted in more thorough surveillances, maintenance, and corrective actions. These actions included the issuing of 2 Information Notices (INs 88-04 and 88-56) and 1 supplement (IN 88-04, Supplement 1). In NUREG-1552, the staff also concluded that the general condition of penetration seal programs in industry appears to be satisfactory. The staff expects that plant-specific deficiencies may occasionally be found during licensee surveillances and NRC inspections. However, it appears that potential penetration seal problems are understood; industry consensus fire test standards are available and are followed; and fire test results and qualified fire-resistant seal materials and designs are available. Therefore, licensees have the means to correct problems and continued staff oversight will continue to ensure corrections on a case-by-case basis. In addition, fire protection defense-in-depth provides reasonable assurance that deficiencies will not present an undue risk to public health and safety until they are found and corrected. In sum, it is the staff's opinion that continued licensee upkeep of existing penetration seal programs and continued NRC inspections are adequate to ensure that penetration seal problems are discovered and resolved and to maintain public health and safety. On these bases and commensurate with the low safety significance of the potential problems, the staff concluded that a generic action that required plant-specific responses was not warranted.

Penetration Seal Installation Problems

QUESTION 2e. What types of enforcement action does NRC plan to take against licensees who have been repeatedly warned of RTV silicone foam firestop deficiencies since 1988 but have not yet taken remedial action?

ANSWER.

Based on reviews of Licensee Event Reports and NRC inspection reports, the staff is not aware of any licensees who have discovered fire penetration seal problems and have not taken, or are not taking remedial action.

Should the NRC staff discover noncompliance with NRC regulations regarding fire barrier penetration seals, it will enforce the Commission's requirements in accordance with the guidance of NUREG-1600, "General Statement of Policy and Procedures for NRC Enforcement Actions," and the "NRC Enforcement Manual." Regulatory requirements have varying degrees of safety significance. Therefore, the relative importance of each violation, including both the technical significance and the regulatory significance is evaluated on a case-by-case basis. Accordingly, the severity of a particular penetration seal issue would need to be assessed on its own merits and could vary from case to case. The staff believes that most violations involving penetration seals would be violations at Severity Level IV, which are violations of more than minor concern which, if left uncorrected, could lead to a more significant concern. The staff would consider the actions taken by licensees in response to previous Information Notices when deciding on enforcement action.